

5. FINDINGS AND CONCLUSIONS

The team reached a number of findings and conclusions during its two-week visit to the NSGA Northwest CDAA site. Many factors affecting signal reception were identified and investigated during the short time at the site. The technical details of the investigation are provided in prior sections of this document and the major findings are summarized below.

- A determination of the present status of power-line noise and its sources was a primary objective of the visit. While the team did not have good records of the sources and magnitude of power-line noise levels from past work, it appears that most of the major sources have been eliminated. We are appreciative of the past work by representatives of NISE East and the Virginia Electric Power Company on this difficult noise-mitigation problem. Several lower-level sources of power-line noise still exist. Since there was not time for a full-scale source-location effort during this trip, additional work on this problem is required.
- RFD loss and RFD noise, although too high for good site performance, is about normal for an ENLARGER-equipped site. Beam-to-beam leakage appeared to be somewhat higher than normal.
- When the RFD noise and leakage problems are corrected and the RFD loss problem is addressed, radio interference from power lines and EMI from digital devices will still limit signal reception to undesirable levels.
- Several sources of harmful EMI from digital power-control devices were identified. The most detrimental source is the variable-speed induction-motor drive located in a room on the northwest side of the Operations Building (Building 41) of the CDAA. It controls the air flow to a portion of the Operations Building. The next source is a UPS located in a satellite communications shelter operated by GE-Americom. This source is especially onerous when a diesel generator for the SATCOM facility is in operation. A third source is the power-supply controller for the field current supplied to two diesel generators located in the NATO SATCOM building. The fourth source of EMI identified in 1988, and reconfirmed as a source during this visit, is the site's primary UPS. Still another digital motor controller is believed to be located in the SATCOM complex northwest of the CDAA in the same general vicinity as the GE-Americom shelter. This source was not located by the team, and it is believed to be not yet in service. Lack of time for all internal and external source-location work precluded further investigation.

- The team is concerned that additional variable-speed induction-motor controllers are likely to be installed at and in the vicinity of the NSGA Northwest CDAA facility in the near future. Typical new locations for such devices are to control support devices in the Operations Building, other buildings on the Northwest base, the hospital under construction adjacent to the base entrance, the waste-treatment plant at the Northwest site, the water-treatment plant along Highway 168 north of the CDAA, and in small business and farming operations within line of sight of the CDAA.
- It will be necessary to establish procedures to ensure that additional motor controllers, UPS, and other power-control devices generating harmful levels of radio interference are not installed at, or near, the Northwest base. In addition, a means to coordinate potential radio-interference problems from such sources needs to be established with local officials and with the two local electric utilities. Otherwise, the motor-controller problem will continue to grow and the reception of radio signals at the site will be restricted to high-level signals of little or no interest.
- The site, in its present state, can detect and receive radio signals from many sources that employ relatively high transmitter power and good transmitting antennas. This creates the illusion that the site is functioning normally, but the site cannot at this time reliably receive signals from many sources of primary interest.
- Effective mitigation techniques are available at low-to-modest cost to correct all radio-interference problems identified during the survey; however, the documentation about methods for the control of internal EMI problems available to site operators and planners is outdated, contains highly misleading (and some incorrect) material, and does not apply to radio receiving sites. The lack of pertinent documentation for the control of sources of EMI from digital devices is a major reason for many of the problems identified at Northwest and other radio receiving sites.

Appendix A
PERSONNEL

PERSONNEL

The NW9705 SNEP team was composed of members selected from a number of government, commercial and industrial entities. All team members have extensive backgrounds and training in the specific work tasks required to complete the objectives of the POAM.

The team members are:

<u>Name</u>	<u>Organization</u>
Pamela J. Guardabascio	NISE East
Richard W. Adler	Naval Postgraduate School
Carlo A. Melnick	Raytheon E-Systems
William A. Briotta	Raytheon E-Systems
George F. Munsch	Consultant
Wilbur R. Vincent	Consultant

The SNEP team is grateful for the support of the Commanding officer of NSGA Northwest, CAPT. Peyronel, the Executive Officer, CDR Delorey, the Electronics Maintenance Officer, CTMCM Robert Goehring, and the Assistant Electronics Maintenance Officer, CTMC Robert Browning. Several of the site staff assisted us on an almost daily basis, including:

<u>Name</u>	<u>Organization</u>
CTMC Albert Martinez	60 Department
CTM1 John Krueger	60 Department
CTM1 Cherie Roche	60 Department
CTM2 Ellen Lampkin	60 Department
CTM2 Edward Sanchez	60 Department
CTM2 Tricia Kelley	60 Department
CTM3 Kristen Lester	60 Department
Mr. Charlie Johnson	60 Department - Electrician
Mr. John Lane	60 Department - Electrician
Mr. Vincent Oakes	GE Americom
Station Engineer Avaransky	NATO SATCOM

We apologize if any were overlooked in assembling this list.

Appendix B
REVIEW OF SOURCES OF POWER-LINE
NOISE IDENTIFIED ON PRIOR VISITS

REVIEW OF SOURCES OF POWER-LINE NOISE IDENTIFIED ON PRIOR VISITS

Available information about sources of power-line noise identified during prior team visits was assembled into a standard data-recording format. The format is provided on Page 36 of the Power-Line Noise Mitigation Handbook.¹

A number of sources were on distribution lines. Those with sufficient information to identify the affected pole were visited by the NW9705 SNEP team. The purpose of the visit was to ascertain their present status, review repairs made to each pole, and obtain GPS location data. The results of these pole visits are presented in this appendix. A source data form is provided for each pole, and these forms follow this introductory information.

Each data sheet identifies the pole location in two separate ways. A brief description of each pole location is provided. This description is sufficient to locate the pole from nearby roads and landmarks. In addition, the location in latitude and longitude, obtained from a GPS receiver, is provided. The GPS also provided the distance from the site to each source and the bearing from the site to each source.

The mitigation action taken to eliminate each source is listed on the form as well as a note about the present activity of each source. The team found that all the listed sources were noise quiet, indicating that the reported mitigation actions were successful.

Partial information about thirteen additional sources located on a transmission line east of the site was available. Source data forms are also provided for these sources, and they are identical to the forms for the distribution lines. A few of these sources were not visited by the NW9705 team due to flooding of the right-of-way for the line from rainstorms prior to and during the team's visit. Only the pole numbers and Virginia Power Company source identification information are provided for a few sources since the remainder of the data could not be obtained during this visit.

¹ Wilbur R. Vincent and George F Munsch, *Power-Line Noise Mitigation Handbook for Naval Receiving Sites*, Prepared for COMNAVSECGRU N-44, 4th edition, April 1997.

Site: Northwest

Source Identification No.: 1

Date: 961107

Time: 1141

Pole ID:

Location: In front of St. Bride's Correctional Facility

Latitude: Unable to obtain GPS data

Longitude:

Site-to-Source Bearing:

Site-to-Source Distance:

Noise Description:

Comments:

Source Hardware: Cooper lightning arrester.

Required Mitigation Actions: Replace Cooper lightning arrester.

Actual Mitigation Actions: Replaced Cooper lightning arrester.

Site: Northwest

Source Identification No.: 2

Date: 961107

Time: 1141

Pole ID: 0F97

Location: Transformer pole feeding administration building at St. Bride's Correctional Facility.

Latitude: 37° 36.70' N

Longitude: 76° 11.07' W

Site-to-Source Bearing: 46°

Site-to-Source Distance: 9.87 km

Noise Description:

Comments : Source pole was quiet when checked on 970429

Source Hardware: Cooper lightning arrester

Required Mitigation Actions: Replace Cooper lightning arrester.

Actual Mitigation Actions: Replaced Cooper lightning arrester.

Site: Northwest

Source Identification No.: 3

Date: 970403

Time: 0915

Pole ID:

Location: Gallbush Rd. a little more than ½ way between sharp bend in road and intersection with Indian Creek Rd.

Latitude: Unable to obtain GPS data

Longitude:

Site-to-Source Bearing:

Site-to-Source Distance:

Noise Description:

Comments :

Source Hardware: Cooper lightning arrester

Required Mitigation Actions: Replace Cooper lightning arrester.

Actual Mitigation Actions: Replaced Cooper lightning arrester.

Site: Northwest

Source Identification No.: 4

Date:

Time:

Pole ID: "FB65" and "M"

Location: Tap line off of Rt. 168. South side of bridge near Seven Eleven on same side of
Rt. 168 as the Seven Eleven.

Latitude: 36° 33.89' N

Longitude: 76° 11.99' W

Site-to-Source Bearing: 78°

Site-to-Source Distance: 5.59 km

Noise Description:

Comments : Source pole was quiet when checked on 970429

Source Hardware: Bell insulators.

Required Mitigation Actions: Replace 2 sets of bells with polymer insulators.

Actual Mitigation Actions: Replaced 2 sets of bells with polymer insulators.

Site: Northwest

Source Identification No.: 5

Date:

Time:

Pole ID: BA05

Location: Tap line off of Ballahack Rd., on the north side of Ballahack, east of transmission line. Go down semiprivate driveway next to tanker trailer. Graveyard is on left side of driveway about 100 feet in. Source pole is at very end beside pond.

Latitude: 36° 33.81' N

Longitude: 76° 12.28' W

Site-to-Source Bearing: 78°

Site-to-Source Distance: 4.98 km

Noise Description:

Comments:

Source Hardware: Tie wire on telephone line hardware.

Required Mitigation Actions: Replace tie wire.

Actual Mitigation Actions:

Site: Northwest

Source Identification No.: 6

Date: 970410

Time:

Pole ID: XM17

Location: Corner of Pine Grove Landing and Ballahack Rd.

Latitude: 36° 34.80' N

Longitude: 76° 15.13' W

Site-to-Source Bearing: 27°

Site-to-Source Distance: 2.21 km

Noise Description:

Comments : Source pole was quiet when checked on 970429

Source Hardware: Bell insulators

Required Mitigation Actions: Replace bells with polymer insulators.

Actual Mitigation Actions: Replaced bells with polymer insulators.

Site: Northwest

Source Identification No.: 7

Date: 951213

Time: 1040

Pole ID: GB08

Location: Indian Creek Rd. Enter from Gallbush Rd., 1st pole on left.

Latitude: 36° 36.49' N

Longitude: 76° 11.88' W

Site-to-Source Bearing: 38°

Site-to-Source Distance: 8.97 km

Noise Description: Bursts of noise

Comments: This is the first of four poles that feed poles for sources 9703-6 and 9703-5.

Source Hardware: Cooper lightning arrester

Required Mitigation Actions: Replace Cooper lightning arrester.

Actual Mitigation Actions: Replaced Cooper lightning arrester

Site: Northwest

Source Identification No.: T-1

Date: 9608

Time:

Pole ID:

Location: Structure 59 on transmission line.

Latitude: 36° 34.71' N

Longitude: 76° 13.49' W

Site-to-Source Bearing: 50°

Site-to-Source Distance: 4.09 km

Noise Description:

Comments:

Source Hardware: Ground wire staple

Required Mitigation Actions:

Actual Mitigation Actions:

Site: Northwest

Source Identification No.: T-2

Date: 9608

Time:

Pole ID:

Location: Structure 60 on transmission line.

Latitude: 36° 34.55' N

Longitude: 76° 13.41' W

Site-to-Source Bearing: 53°

Site-to-Source Distance: 4.0 km

Noise Description:

Comments:

Source Hardware: Ground wire staple

Required Mitigation Actions:

Actual Mitigation Actions:

Site: Northwest

Source Identification No.: T-3

Date: 9611

Time:

Pole ID:

Location: Structure 62 on transmission line.

Latitude: Unable to obtain GPS data

Longitude:

Site-to-Source Bearing:

Site-to-Source Distance:

Noise Description:

Comments:

Source Hardware: Ground wire staple

Required Mitigation Actions:

Actual Mitigation Actions:

Site: Northwest

Source Identification No.: T-4

Date: 9606

Time:

Pole ID:

Location: Structure 69 on transmission line.

Latitude: 36° 33.41' N

Longitude: 76° 12.84' W

Site-to-Source Bearing: 86°

Site-to-Source Distance: 4.04 km

Noise Description:

Comments:

Source Hardware: Ground wire staple

Required Mitigation Actions:

Actual Mitigation Actions:

Site: Northwest

Source Identification No.: T-5

Date: 9611

Time:

Pole ID:

Location: Structure 72 on transmission line.

Latitude: Unable to obtain GPS data

Longitude:

Site-to-Source Bearing:

Site-to-Source Distance:

Noise Description:

Comments:

Source Hardware: Ground wire staple

Required Mitigation Actions:

Actual Mitigation Actions:

Site: Northwest

Source Identification No.: T-6

Date: 9606

Time:

Pole ID:

Location: Structure 77 on transmission line.

Latitude: 36° 32.48' N

Longitude: 76° 12.29' W

Site-to-Source Bearing: 100°

Site-to-Source Distance: 5.05 km

Noise Description:

Comments:

Source Hardware: Ground wire staple

Required Mitigation Actions:

Actual Mitigation Actions:

Site: Northwest

Source Identification No.: T-7

Date: 9606

Time:

Pole ID:

Location: Structure 78 on transmission line.

Latitude: 36° 32.58' N

Longitude: 76° 12.28' W

Site-to-Source Bearing: 104°

Site-to-Source Distance: 5.25 km

Noise Description:

Comments:

Source Hardware: Ground wire staple

Required Mitigation Actions:

Actual Mitigation Actions:

Site: Northwest

Source Identification No.: T-8

Date: 9606

Time:

Pole ID:

Location: Structure 79 on transmission line.

Latitude: 36° 32.22' N

Longitude: 76° 12.13' W

Site-to-Source Bearing: 111°

Site-to-Source Distance: 5.41 km

Noise Description:

Comments:

Source Hardware: Ground wire staple

Required Mitigation Actions:

Actual Mitigation Actions:

Site: Northwest

Source Identification No.: T-9

Date: 9704

Time:

Pole ID:

Location: Structure 80 on transmission line.

Latitude: 36° 32.06' N

Longitude: 76° 12.08' W

Site-to-Source Bearing: 113°

Site-to-Source Distance: 5.6 km

Noise Description:

Comments:

Source Hardware: Ground wire staple

Required Mitigation Actions:

Actual Mitigation Actions:

Site: Northwest

Source Identification No.: T-10

Date: 9611

Time:

Pole ID:

Location: Structure 81 on transmission line.

Latitude: 36° 31.97' N

Longitude: 76° 12.02' W

Site-to-Source Bearing: 114°

Site-to-Source Distance: 5.76 km

Noise Description:

Comments:

Source Hardware: Ground wire staple

Required Mitigation Actions:

Actual Mitigation Actions:

Site: Northwest

Source Identification No.: T-11

Date: 9611

Time:

Pole ID:

Location: Structure 82 on transmission line.

Latitude: 36° 31.80' N

Longitude: 76° 11.94' W

Site-to-Source Bearing: 116°

Site-to-Source Distance: 6.0 km

Noise Description:

Comments:

Source Hardware: Ground wire staple

Required Mitigation Actions:

Actual Mitigation Actions:

Site: Northwest

Source Identification No.: T-12

Date: 9606

Time:

Pole ID:

Location: Structure 83 on transmission line.

Latitude: 36° 31.69' N

Longitude: 76° 11.87' W

Site-to-Source Bearing: 118°

Site-to-Source Distance: 6.18 km

Noise Description:

Comments:

Source Hardware: Ground wire staple

Required Mitigation Actions:

Actual Mitigation Actions:

Site: Northwest

Source Identification No.: T-13

Date: 9608

Time:

Pole ID:

Location: Structure 89 on transmission line.

Latitude: 36° 30.94' N

Longitude: 76° 11.27' W

Site-to-Source Bearing: 124°

Site-to-Source Distance: 7.68 km

Noise Description:

Comments:

Source Hardware: Ground wire staple

Required Mitigation Actions:

Actual Mitigation Actions:

Appendix C
NEW SOURCES OF POWER-LINE NOISE

NEW SOURCES OF POWER-LINE NOISE

This appendix provides a record of each new case of radio interference which was traced to a source on a power line during the NW9705 SNEP team visit. The procedure used to locate each source is provided in a handbook developed specifically for use at naval receiving sites¹.

The source information form used on previous SNEP surveys was used to record information about each new source. Copies of these forms follow this introductory material. Each form contains a noise-source serial number and a date and time of the source identification.

The location of each pole containing a source of radio noise is provided in two ways. A brief written description is given. This description is sufficient to drive to each location with the aid of a standard road and street map. In addition, the latitude and longitude of each location is determined by a GPS receiver. The GPS also provides the distance from the site to each source and the bearing from the site to each source.

A brief description of the temporal properties of each source of noise is provided. This description must be verified by both the internal team assessing the magnitude of the noise source at the input to a receiver and the external team at the source pole. This description is sometimes sufficient to identify the type of hardware harboring the noise source.

The identification of the actual source hardware is accomplished with an RF/Acoustic Sniffer. The use of the Sniffer requires a utility-rated bucket truck to elevate the Sniffer to near vicinity of the source hardware.

The next to the last item on the source information page, *Required Mitigation Actions*, cannot be completed until the actual source hardware is identified. Once the source hardware is identified, the mitigation action is often obvious. The last item on the page, *Actual Mitigation Actions*, cannot be completed until the utility operating the lines takes corrective action. This item is used to determine the long-term effectiveness of mitigation actions.

¹ Wilbur R. Vincent and George F. Munsch, *Signal-to-Noise Enhancement Program Power-Line Noise Mitigation Handbook for Naval Receiving Sites*, 4th Edition, prepared for COMNAVSECGRU, January 1997.

Only poles proven to have a source that adversely affects the reception of radio signals at the NSGA Northwest receiving site are listed. Many sources are found by the external team which do not affect signal reception; these sources are ignored.

A copy of this appendix was provided to Mr. Harry Glessner of Virginia Power so that he could begin the mitigation actions on the sources identified herein.

Site: Northwest

Source Identification No.: 9704-1

Date: 970429

Time: 1540

Pole ID: 1J48

Location: Corner of Gallbush Rd. and Penny Lane

Latitude: 36° 34.57' N

Longitude: 76° 11.61' W

Site-to-Source Bearing: 51°

Site-to-Source Distance: 6.6 km

Noise Description: Erratic spitting noise, one pair of bursts about every 2 seconds. Bi-polar, 3 impulses per burst, erratic amplitude.

Comments: Light on pole, pin insulators

Source Hardware:

Required Mitigation Actions:

Actual Mitigation Actions:

Site: Northwest

Source Identification No.: 9704-02

Date: 970429

Time: 1600

Pole ID: 125A

Location: On Gallbush, 1 span in from Rt. 168

Latitude: 36° 34.52' N

Longitude: 76° 11.95' W

Site-to-Source Bearing: 51°

Site-to-Source Distance: 6.13 km

Noise Description: Multiple pulses, closely spaced.

Comments:

Source Hardware:

Required Mitigation Actions:

Actual Mitigation Actions:

Site: Northwest

Source Identification No.: 9704-03

Date: 970501

Time: 0921

Pole ID: 20 AMP (top), N0600 (middle), G152 (bottom)

Location: Corner of NW Backwoods Rd. and Bermuda Lane.

Latitude: 36° 30.79' N

Longitude: 76° 14.36' W

Site-to-Source Bearing: 159°

Site-to-Source Distance: 4.91 km

Noise Description: Bi-polar, 4-6 pulses on each polarity, constant amplitude.

Comments: Single-phase line, source pole has fuse cutout and underground transition.

Source Hardware: Suspect bell insulators

Required Mitigation Actions:

Actual Mitigation Actions:

Site: Northwest

Source Identification No.: 9704-04

Date: 970501

Time: 0927

Pole ID: G173

Location: On NW Backwoods Rd. across from source 9704-3.

Latitude: 36° 30.79' N

Longitude: 76° 14.36' W

Site-to-Source Bearing: 159°

Site-to-Source Distance: 4.91 km

Noise Description: Same as 9704-3

Comments: Source pole is on main line and feeds 9704-3.

Source Hardware: Suspect bell insulators.

Required Mitigation Actions:

Actual Mitigation Actions:

Site: Northwest

Source Identification No.: 9704-05

Date: 970501

Time: 1000

Pole ID: AN11

Location: Backwoods Rd. across from Hunt Club.

Latitude: 36° 32.28' N

Longitude: 76° 15.02' W

Site-to-Source Bearing: 129°

Site-to-Source Distance: 1.55 km

Noise Description: Bi-polar, erratic spacing (close to large), erratic amplitude, steady operation of source.

Comments: Local residents complaining of TV interference problems.

Source Hardware: Suspect loose pin insulators or loose pin bolt on crossarm. Dry rot is present on crossarm.

Required Mitigation Actions: Tighten pin insulators on pin bolts, tighten all hardware.
Replace crossarm if pin bolts cannot be tightened. Add flat washers and 2-turn lock washers to pin bolts.

Actual Mitigation Actions:

Site: Northwest

Source Identification No.: 9704-06

Date: 970501

Time: 1138

Pole ID: 0D45

Location: From South Mills Rd enter SR 1228(Newtown Rd), turn right onto SR 1266 (Richard Shaw Rd), follow SR 1266 into residential area. SR 1266 becomes Rt. 4, source pole is located on private property located on Rt. 4, Box 115, name of resident is B. Reese. Source pole is on right side of house.

Latitude: 36° 31.64' N

Longitude: 76° 11.08' W

Site-to-Source Bearing: 113°

Site-to-Source Distance: 7.29 km

Noise Description: Bi-polar, 4-5 pulses each polarity, variable spacing. Amplitude varies about ± 5 dB, steady operation.

Comments:

Source Hardware: Suspect bell insulator support hardware.

Required Mitigation Actions: Replace bells with polymers, tighten all hardware.

Actual Mitigation Actions:

Appendix D

IONOSPHERIC ACTIVITY REPORTS

IONOSPHERIC ACTIVITY REPORTS

This section contains copies of the daily Ionospheric Reports issued by the National Institutes of Science and Technology and broadcast hourly over their standard time and frequency radio stations. These reports, which are also available over the Internet, are monitored at least once a day to provide the SNEP team with data relating to the condition of the ionosphere and the resulting effects on radio-signal propagation. Knowledge and understanding of these parameters is necessary for several key reasons. The first is to properly execute the PROPHET signal propagation program, since the Solar Flux is one of the more critical inputs. An equally important application is to provide team members with a reference against which to judge observed signal levels and to determine which frequency bands are expected to be usable. Details of the reports, their derivation, purpose and meaning are fully presented in the text of a new handbook¹. The reader is referred to it for additional information on the many aspects of HF propagation which have direct consequences to receiving sites.

No major ionospheric storms or disturbed signal propagation conditions occurred during the 9705 SNEP visit. The minor storm reported on Friday, 970502 had no perceptible effect on the SNEP measurements.

¹ George Jacobs, Theodore J. Cohen, and Robert B. Rose; *The New Shortwave Propagation Handbook*, CQ Communications, 76 N. Broadway, Hicksville, N. Y. 11801

Daily Ionospheric Report

Date : 970428 Time : 10:18 L

Station : WWV

Solar Flux : 73

WWV: HH:18

WWVH: HH:45

Boulder A Index : 2

Boulder K Index at 12 00 UT on 28 Apl was 2 .

Solar-Terrestrial Conditions for the last 24 hours:

Solar Activity : Very Low

Geomagnetic Field : Quiet

(Special Conditions) : _____

Forecast for the Next 24 Hours:

Solar Activity : Very Low

Geomagnetic Field : Quiet

Daily Ionospheric Report

Date : 970429 Time : 1518 L Station : WWV

Solar Flux : 72

WWV: HH:18

WWVH: HH:45

Boulder A Index : 2

Boulder K Index at 18 00 UT on 29 Apl was 1 .

Solar-Terrestrial Conditions for the last 24 hours:

Solar Activity : Very Low

Geomagnetic Field : Quiet

(Special Conditions) : _____

Forecast for the Next 24 Hours:

Solar Activity : Very Low

Geomagnetic Field : Quiet to Unsettled

Daily Ionospheric Report

Date : 970430 Time : 09:18 L Station : WWV

Solar Flux : 72 WWV: HH:18
WWVH: HH:45

Boulder A Index : 2

Boulder K Index at 12 00 UT on 30 Apl was 1 .

Solar-Terrestrial Conditions for the last 24 hours:

Solar Activity : Very Low

Geomagnetic Field : Quiet to Active

(Special Conditions) : _____

Forecast for the Next 24 Hours:

Solar Activity : Very Low

Geomagnetic Field : Quiet to Unsettled

Daily Ionospheric Report

Date : 970501 Time : 10:18 L Station : WWV

Solar Flux : 73

WWV: HH:18

WWVH: HH:45

Boulder A Index : 10* (May not be copied correctly due to static crashes.

Boulder K Index at 12 00 UT on 1 May was 2 .

Solar-Terrestrial Conditions for the last 24 hours:

Solar Activity : Very Low

Geomagnetic Field : Quiet to Unsettled

(Special Conditions) : _____

Forecast for the Next 24 Hours:

Solar Activity : Very Low

Geomagnetic Field : Quiet to Unsettled

Daily Ionospheric Report

Date : 970502 Time : 09:18 L

Station : WWV

Solar Flux : 72

WWV: HH:18

WWVH: HH:45

Boulder A Index : 18

Boulder K Index at 12 00 UT on 2 May was 2 .

Solar-Terrestrial Conditions for the last 24 hours:

Solar Activity : Very Low

Geomagnetic Field : Quiet to Minor Storm

(Special Conditions) : _____

Forecast for the Next 24 Hours:

Solar Activity : Very Low

Geomagnetic Field : Minor Storm

Daily Ionospheric Report

Date : 970505 Time : 9:18 L Station : WWV

Solar Flux : 71

WWV: HH:18

WWVH: HH:45

Boulder A Index : 5

Boulder K Index at 12 00 UT on 5 May was 1 .

Solar-Terrestrial Conditions for the last 24 hours:

Solar Activity : Very Low

Geomagnetic Field : Quiet to Unsettled

(Special Conditions) : _____

Forecast for the Next 24 Hours:

Solar Activity : Very Low

Geomagnetic Field : Quiet to Unsettled

Daily Ionospheric Report

Date : 970506 Time : 9:18 L

Station : WWV

Solar Flux : 71

WWV: HH:18

WWVH: HH:45

Boulder A Index : 5

Boulder K Index at 12 00 UT on 6 May was 1 .

Solar-Terrestrial Conditions for the last 24 hours:

Solar Activity : Very Low

Geomagnetic Field : Quiet to Unsettled

(Special Conditions) : _____

Forecast for the Next 24 Hours:

Solar Activity : Very Low

Geomagnetic Field : Quiet to Unsettled

WILBUR R. VINCENT
26070 Kriste Ln.
Los Altos Hills, CA 94022

W.R. Vincent

REPORT NO. UMTA-MA-06-0041-80-1

LORAN-C RFI MEASURED IN LOS ANGELES, CALIFORNIA

W.R. Vincent
G. Sage

Systems Control, Inc. (Vt)
1801 Page Mill Road
Palo Alto, CA 94304



OCTOBER 1980

FINAL REPORT

DOCUMENT IS AVAILABLE TO THE PUBLIC
THROUGH THE NATIONAL TECHNICAL
INFORMATION SERVICE, SPRINGFIELD,
VIRGINIA 22161

Prepared for

U.S. DEPARTMENT OF TRANSPORTATION
URBAN MASS TRANSPORTATION ADMINISTRATION
Office of Technology Development and Deployment
Office of Bus and Paratransit Technology
Washington DC 20590

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1. Report No. UMTA-MA-06-0041-80-1		2. Government Accession No.		3. Recipient's Catalog No.	
4. Title and Subtitle LORAN-C RFI MEASURED IN LOS ANGELES, CALIFORNIA				5. Report Date October 1980	
				6. Performing Organization Code DTS-721	
7. Author(s) W.R. Vincent, G. Sage				8. Performing Organization Report No. DOT-TSC-UMTA-80- 38	
9. Performing Organization Name and Address Systems Control, Inc. (Vt)* 1801 Page Mill Road Palo Alto, CA 94304				10. Work Unit No. (TRAIS) UM011/R0702	
				11. Contract or Grant No. DOT-TSC-1237	
12. Sponsoring Agency Name and Address U.S. Department of Transportation Urban Mass Transportation Administration Office of Technology Development and Deployment Office of Bus and Paratransit Technology Washington DC 20590				13. Type of Report and Period Covered Final Report December 1978-January 1979	
				14. Sponsoring Agency Code UTD-22	
15. Supplementary Notes *Under subcontract to: Gould Inc., Information Identification Division, 2908 Cullen Street, Fort Worth, TX 76107. Gould Inc. under contract to U.S. Department of Transportation, Research and Special Programs Administration, TSC, Cambridge, MA 02142.					
16. Abstract This report describes the tests that were conducted to determine the nature of Loran-C RFI in the Los Angeles area. Six important noise types were identified. They were traced to probable sources in each case. Their spatial distribution precludes gradient mapping; rather, there are strong-signal regions juxtaposed with sharp boundaries to a large number of regions of various sizes in which noise predominates so as to make the available signal unusable.					
17. Key Words Loran-C radio-frequency interference noise spectrum				18. Distribution Statement DOCUMENT IS AVAILABLE TO THE PUBLIC THROUGH THE NATIONAL TECHNICAL INFORMATION SERVICE, SPRINGFIELD, VIRGINIA 22161	
19. Security Classif. (of this report) Unclassified		20. Security Classif. (of this page) Unclassified		21. No. of Pages	
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PREFACE

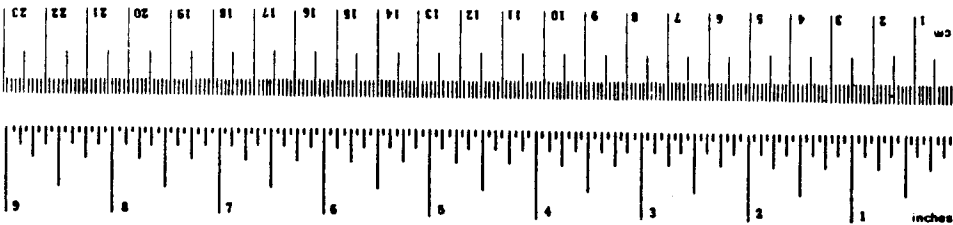
This report presents the results of tests conducted to determine the nature of Loran-C RFI in the Los Angeles area which would be encountered by vehicularly installed Loran-C navigation systems.

The tests were conducted by Systems Control, Inc. (SCI (Vt)) under subcontract to Gould Inc., Information Identification Division under Contract No. DOT-TSC-1237. The text was prepared by W.R. Vincent and G. Sage of SCI (Vt), while the summary was prepared by John Hovorka of the Transportation Systems Center and Fred Heathcock of Gould Inc. The work was sponsored by the Urban Mass Transportation Administration, Office of Bus and Paratransit.

METRIC CONVERSION FACTORS

Approximate Conversions to Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
LENGTH				
in	inches	2.5	centimeters	cm
ft	feet	30	centimeters	cm
yd	yards	0.9	meters	m
mi	miles	1.6	kilometers	km
AREA				
in ²	square inches	6.5	square centimeters	cm ²
ft ²	square feet	0.09	square meters	m ²
yd ²	square yards	0.8	square meters	m ²
mi ²	square miles	2.6	square kilometers	km ²
	acres	0.4	hectares	ha
MASS (weight)				
oz	ounces	28	grams	g
lb	pounds	0.45	kilograms	kg
	short tons (2000 lb)	0.9	tonnes	t
VOLUME				
teaspoon	teaspoons	5	milliliters	ml
tablespoon	tablespoons	15	milliliters	ml
fluid ounce	fluid ounces	30	milliliters	ml
cup	cup	0.24	liters	l
pt	pints	0.47	liters	l
qt	quarts	0.95	liters	l
gal	gallons	3.8	liters	l
ft ³	cubic feet	0.03	cubic meters	m ³
yd ³	cubic yards	0.76	cubic meters	m ³
TEMPERATURE (exact)				
°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C



Approximate Conversions from Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
LENGTH				
mm	millimeters	0.04	inches	in
cm	centimeters	0.4	inches	in
m	meters	3.3	feet	ft
km	kilometers	1.1	miles	mi
		0.6	miles	mi
AREA				
cm ²	square centimeters	0.16	square inches	in ²
m ²	square meters	1.2	square yards	yd ²
km ²	square kilometers	0.4	square miles	mi ²
ha	hectares (10,000 m ²)	2.5	acres	ac
MASS (weight)				
g	grams	0.035	ounces	oz
kg	kilograms	2.2	pounds	lb
t	tonnes (1000 kg)	1.1	short tons	sh
VOLUME				
ml	milliliters	0.03	fluid ounces	fl oz
l	liters	2.1	pints	pt
		1.06	quarts	qt
		0.26	gallons	gal
m ³	cubic meters	35	cubic feet	ft ³
		1.3	cubic yards	yd ³
TEMPERATURE (exact)				
°C	Celsius temperature	9/5 (then add 32)	Fahrenheit temperature	°F

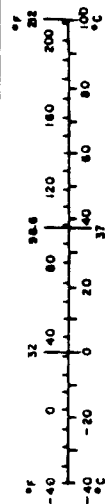


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